TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 300

THE VARIATION IN PRESSURES IN THE COCKPIT OF AN AIRPLANE IN FLIGHT

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Summary

The results of an investigation to determine the pressures in the open cockpit of a Vought VE-7 airplane are given. The information has been considered valuable on account of its possible effect upon the operation of instruments, particularly altimeters, due to a variation from the true static pressure which is induced by the passage of the airplane through the air. The observed values are in general small and the effect upon instruments is inconsiderable.

This investigation has been undertaken in order to provide information as to the variation in pressure within the fuselage of an airplane which might produce erroneous indication by instruments with particular regard to altimeters.

The airplane which was used was a Vought VE-7 airplane, which is of the open cockpit type with normal windshields installed on each of the two cockpits. A standard N.A.C.A. pressure recording instrument (Reference 1) was used in conjunction with a swiveling static head mounted upon a forward outer bay strut in the usual position. To the other side of the instrument a special hand held static head was connected. The differences in pressure thus observed are shown in Tables I and II. As a check on the value and constancy of the pressure at the swiveling static head, it was compared in all conditions of flight with a true static pressure provided by a trailing head suspended 30 feet below the airplane in flight. The difference observed was an increase of pressure at the swiveling static head of 0.16 inch of water which was constant throughout the range of speeds from 60 to 120 M.P.H. It was therefore considered that the static pressure provided by the swiveling static head was sufficiently true and constant for comparison with the pressures observed in the various positions within the fuselage.

Several positions were investigated in both the front and rear cockpit and are indicated in Figure 1 on the cross section of the fuselage. A number of other positions were investigated which might be occupied by instruments and the results were found to be in general conformity with the tabulated information.

The airplane was flown through a series of speeds of from 60 to 120 M.P.H. in the condition of level flight and of climb. The results are given in Table I.

The minimum observed depression in the cockpit was found to be .39 inch of H_2O at 60 M.P.H., gliding.

A greater depression was induced within the fuselage with increase of speed and the maximum depression observed occurred at 120 M.P.H. in the climbing attitude, the depression being 1.74 in. of H_2O.

To determine the effect of altitude upon the cockpit pressures, observations were made in corresponding flights at altitudes of 1000 ft. and at 10,000 ft.; the observed pressures are given in Table II and the differences are observed to be small.

It is therefore observed that the maximum difference between the true static and the pressure in the cockpit of this type of airplane is only about $1\frac{1}{2}$ in. of water. This would induce a maximum error in an altimeter of 115 ft. which may be expected due to the cockpit depression and its effect upon the instrument.

Greater or less divergence may be expected in cabin types or possibly in other open cockpit types of different conformation from the VE-7, but it need not be expected that its effect may be great upon the information provided by altimeters or other instruments which would be affected by the static pressure within the cockpits. If a greater precision than this is required, it is easily obtained by sealing the instrument and connecting the static side with the static side of the pitot-static air speed head, preferably of the swiveling type.

Langley Memorial Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., June 20, 1928.

Reference

1. Norton, F. H. : N.A.C.A. Recording Air Speed Meter. N.A.C.A. Technical Note No. 64. (1921)

TABLE I.

Front Cockpit at 1000 Feet

Pressures are given in inches of H_2O

	Air speed 60 M.P.H.			80 M.P.H.					100 M.P.H.					120 M.P.H.	
Pos. No.	Level flight	Climb	Glides	Level	Climb	Glides	Turns	Pull ups	Level	Climb	Glides	Turns	Pull ups	Level	Glides
1	.52	.58	.40	.88	.88	.52	.87	.68	1.34	1.34	1.00	1.34	1.14	1.64	1.72
2	.52	.58	.44	.78	.90	.52	.89	.68	1.34	1.34	1.06	1.34	1.14	1.64	1.72
3	.46	.53	.39	.74	.90	.52	.82	.69	1.26	1.34	1.06	1.24	1.14	1.66	1.74
4	.48	.53	.39	.74	.90	.52	.78	.69	1.26	1.34	1.06	1.24	1.14	1.64	1.72
5	.44	.53	.39	.76	.90	.52	.78	.69	1.26	1.34	9.6	1.24	1.14	1.64	1.72
6	.44	.53	.39	.76	.90	.52	.82	.69	1.26	1.34	9.6	1.24	1.14	1.64	1.74

TABLE II.

Rear Cockpit at 1000 Feet.

Pressures are given in inches of H_2O.

	Air speed 60 M.P.H.			120 M.P.H.	
Pos. No.	Level	Climb		Level	Climb
1	.56	.77		1.88	1.34
7	.49			1.88	
3	.49	.74		1.88	1.22

Rear Cockpit at 10,000 Feet

	Air speed 60 M.P.H.			120 M.P.H.	
Pos. No.	Level	Climb		Level	Climb
1	.39	.54		1.52	1.94
7	.39			1.62	
3	.45	.49		1.52	1.94

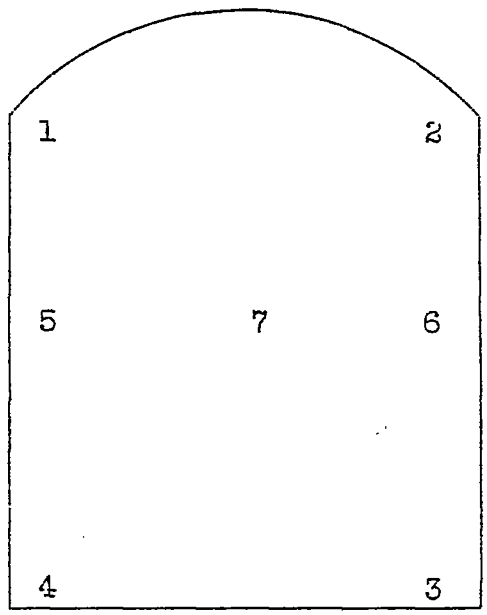

Fig.1